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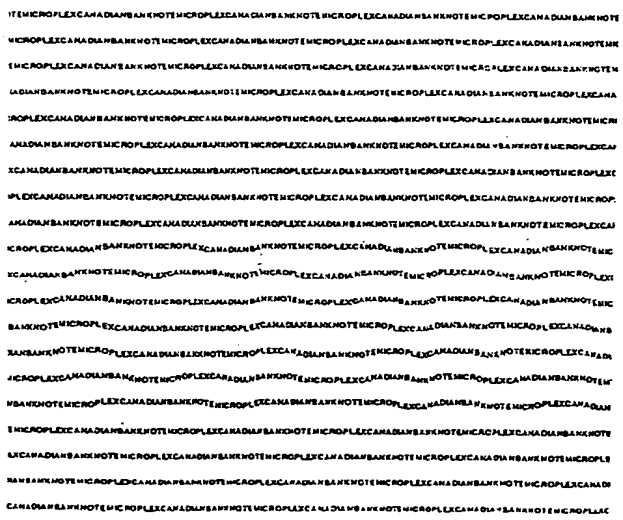
(54) **Latent images comprising phase shifted micro printing.**

(57) A security device comprising a substrate having applied thereto an array of characters, the characters being of a sufficiently small size as to appear uniform when ordinarily viewed but individually identifiable when viewed with the aid of appropriate magnification means, whereby group(s) of the characters are phase-shifted relative to the others in such a manner as to collectively define an image, the image being relatively indiscernible when the device is ordinarily viewed but discernible when viewed with the aid of a finding screen.

Fig. 1



EP 0 520 363 A1

FIELD OF THE INVENTION

The invention relates generally to the field of security printing and, more particularly, to a computer-generated printed security device comprising microscopic characters, group(s) of which are phase shifted relative to others so as to form a latent image which is macroscopically viewable with the aid of a finding screen.

BACKGROUND

The printing of latent images per se, for purposes of security or authentication, is known. For example, Canadian Patent No. 1,172,282 to Trevor Merry provides a security device comprising overlying line deflection patterns which produce different macroscopically viewable images when overlain at different positions by a finding screen . The latent image disclosed by the said Canadian patent is comprised of parallel lines, portions of which are deflected a predetermined distance in the area of the latent image to define the same. The lines are, of course, readily visible and do not themselves provide any additional security feature apart from the latent image. Thus, in order to increase the level of security provided by such a security device it was previously necessary to combine a separate security feature with the device, thereby adding printing or embossing steps to the overall process for producing the desired security document.

SUMMARY OF THE INVENTION

In accordance with the invention there is provided a security device, and method for producing the same, which itself provides two distinct security features, one at a microscopic level and the other at a macroscopic level. The security device comprises a substrate having applied thereto an array of characters. The characters are of a sufficiently small size as to appear uniform when ordinarily viewed but individually identifiable when viewed with the aid of appropriate magnification means. Group(s) of said characters are phase-shifted relative to the others in such a manner as to collectively define a latent image, the image being relatively indiscernible when the device is ordinarily viewed but discernible when viewed with the aid of a finding screen.

Preferably the array of characters comprises a plurality of lines of alphanumeric characters. The characters preferably occupy an area of less than .2 square millimetres and have a density in the range of 1-3 character lines per millimeter.

Use of a dark background and light characters may be preferred. Preferably the application of the array of characters includes the use of a computer to generate the array.

SUMMARY OF THE DRAWINGS

The invention is described below with reference to the following drawings:

Figure 1 is an enlarged illustration of a micro character array in accordance with the invention (The individual characters of the repeated message "Canadian Bank Note Microplex" actually occupying a space of about 0.18 mm square).

Figure 2 is an illustration of another example of a micro character array in accordance with the invention (again, the individual characters actually occupying a space of about 0.18 mm square).

Figure 3 is an illustration of the arrays of Figures 1 and 2 interlaced such that the two macroscopic images defined thereby occupy alternating lines ofthe characters.

Figure 4 is an illustration of the positioning of the macroscopic image "CBN" within a character array. (This figure has been enlarged and an outline of the macroscopic image has been superimposed on the character array in order to more clearly illustrate the invention).

Figure 5 illustrates an alternate macroscopic image "MRP" in similar manner to that of Figure 4.

Figure 6 is an enlarged illustration of a micro character array in accordance with another embodiment of the invention, whereby a dark background surround light characters.

Figure 7 is an enlarged illustration of a micro character array in accordance with another embodiment of the invention, whereby the characters and the backgrounds thereof alternate between white and black, respectively, for each successive line of characters.

Figure 8 is a flow chart diagram of the steps which are performed by a computer to generate an array of micro characters, groups of which are phase shifted relative to the others to collectively form a macroscopic image.

DETAILED DESCRIPTION OF THE INVENTION

The invention is a security device comprising a pattern of microscopic characters, group(s) of which are phase-shifted relative to the others to collectively define a latent image which is macroscopically viewable with the aid of a finding screen such as a lenticular screen (described below). Figures 1 and 2 show examples of security devices in accordance with the invention; for purposes of illustration the printing of those figures has been substantially enlarged so that the microscopic characters may be readily viewed by the reader. However, in actuality the individual characters compris-

ing the repeated message "CANADIAN BANK NOTE MICROPLEX" occupy a space of only about 0.18 mm square. The characters (which, alternatively, may make up any word, phrase or symbol) are spaced in lines or columns about 0.18 mm apart which results in a character density of about 2.75 character lines per millimeter. Generally, the characters preferably occupy an area of less than .2 mm square (i.e. 2 mm x .2 mm) and have a density in the range of 1-3 character lines per millimeter. Thus, the characters are not readily viewable and, at a macroscopic level, appear to be uniform non-distinct lines or other print elements. However, the individual characters are viewable with the aid of a microscope or suitable magnifying lens.

As illustrated by the drawings the micro characters (i.e. in the case of Figures 1 through 7, the letters comprising the character string "CANADIAN BANK NOTE MICROPLEX" are printed to form an array of rows (i.e. lines) and columns. Macroscopically, the character array appears generally uniform, particularly in the example shown by Figures 6 and 7 in which light characters appear within a dark background, but microscopically the alphanumeric characters are individually identifiable and able to convey meaningful information. Portions of the lines and columns comprising the characters are phase-shifted to collectively form larger characters or symbols, for example the letters "CBN" or "MRP" most clearly illustrated by Figures 4 and 5 respectively which are discernable only when the array is viewed through a finding screen. As described below, the pattern of the micro characters, including the phase-shifting, is most conveniently generated by a computer, as is the required pattern for the finding screen.

The characters (or groups of characters) are shifted above or below the centerline of the character string by a distance of about one half the character height (i.e. about 0.09 mm). This phase shifting of the individual pre-selected characters is pre-arranged to, collectively, define a message comprising a word or symbol at a macroscopic level. If desired, two sets of character strings may be independently phase-shifted to macroscopically define two distinct messages as shown by Figure 3 of the drawings. The shifting of the characters is gradual, retaining a continuum of legible information across the boundary between the background and the macroscopically viewable image. By this means, the macroscopic image is not perceived without the assistance of the viewing screen, while at the macroscopic level, integrity of the individual characters and words is maintained.

Figure 8 provides a flow chart of a sequence of steps which are performed by a computer to generate the character arrays of Figures 1 through 7. Of course, many program instruction sets night be developed on the basis of the flow-chart of Figure 8 depending upon the selected computer and output device and the specific characters and messages to be produced thereby, which are not specific to the subject matter claimed herein.

Computer-generated imaging is well known in the security printing industry and does not, per se, form any aspect of the present invention. Such imaging method provides a convenient and practical means of implementing the invention by reason of the degree of precision and control provided thereby.

The preferred methods of printing the character array are intaglio and offset lithography according to the conventional and well-known procedures in the industry. Embossing printing methods may also be appropriate where the security device is required for, for example, aluminized foil lottery tickets or where plastic laminates are used to protect identification documents.

The latent image within the printed character array, according to the foregoing, is viewable by overlaying the array with a lenticular finding screen comprising a set of convex plano-cylindrical lenses having the same line (or column) frequency as the character strings. When the lenses are aligned parallel to the character strings, the latent image is viewed at a slightly different angle than the array due to refraction. To construct the line pattern of the plano-cylindrical lenses it is convenient to generate the same by means of a computer such that a set of computer generated lines having the same frequency as the character strings can be produced on photographic film. The lines are then etched through a photo sensitive resist into a suitable substrate such as copper using a solution of ferric chloride. Each line is reproduced as a concave depression in the copper with a maximum depth of 0.15 mm. After polishing the copper mould can be used to produce screens by heating a transparent plastic material such as PLEXIGLASS (trade-mark) under pressure against the mould. The plastic flows into the depressions forming a set of convex plano-cylindrical lenses raised above a base about 1mm thick. It will be appreciated that other lens arrays having optical characteristics matched to specific character line frequencies can be readily generated by this means.

The sequence of steps performed by a computer to generate the character arrays of Fig. 1-7 according to Fig. 8 may comprise the following steps:

(1) Create outline graphic objects (this can be an outline font or any graphic objects created with a drawing program or explizitly programmed).

(2) Stroke or fill our lines to create proof (use of

Postscript language and interpreters can simplify this step).

(3) Edit outlines (step (1) includes step (2) and (3)).

(4) Output objects as lines and curves (use of PostScript language and interpreters can simplify this step).

(5) Analyzing program finds intersections between parallel lines and objects (options to the analyzing program include the line spacing and length).

(6) File of intersections.

All these steps are depicted in Fig. 8A.

When at least one file of intersections is created in a further step (7) a plotting program may be used to generate the image (Fig. 8B). Multiple files of intersections may be plotted, each for a different object or set of objects can be combined together (the plotting program may conveniently be executed on a PostScript interpreter which allows enlarged proofing on a laser printer and high quality real size film output on a photosetter; the output may be as lines or as text tracking the lines (character lines); options to the plot program include: The height of the shift, the slope of the run-up and run-down, the character string, font, size and face (white or black)). The plotting program may be used to produce laser proofs and production film.

Claims

1. A security device comprising both microscopic and macroscopic hidden images, said device comprising a substrate having applied thereto an array of alphanumeric characters, said characters being of a sufficiently small size as to appear uniform when ordinarily viewed but collectively forming a microscopic image capable of conveying meaningful information when viewed with the aid of appropriate magnification means, whereby group(s) of said characters are phase-shifted relative to other said characters in such a manner as to collectively define a macroscopic image, said macroscopic image being relatively indiscernible when said device is ordinarily viewed but discernible when viewed with the aid of a finding device.

2. A security device according to claim 1 wherein said array of alphanumeric characters comprises a plurality of lines of alphanumeric characters.

3. A security device according to claim 1 or 2 wherein said microscopic image comprises one or more words.

4. A security device according to one or more of claims 1 to 3 wherein each of said alphanumeric characters occupies an area of less than .2 millimetres square.

5. A security device according to one or more of claims 1 to 4 wherein the density of said alphanumeric characters is in the range of 1-3 character lines per millimetre.

6. A method of making a security device comprising both macroscopic and miscroscopic hidden images, comprising the steps of applying to a substrate an array of alphanumeric characters, said characters being of a sufficiently small size as to appear uniform when ordinarily viewed but collectively forming a microscopic image capable of conveying meaningful information when viewed with the aid of appropriate magnification means, and positioning groups(s) of said characters in phase-shifted relation relative to other said characters so as to collectively define a macroscopic image, said macroscopic image being relatively indiscernible when said device is ordinarily viewed but discernible when viewed with the aid of a finding device.

7. A method according to claim 6 whereby said application of said array of alphanumeric characters includes the use of a computer to generate said array.

8. A method according to claim 6 or 7 wherein said array of alphanumeric characters comprises a plurality of lines of characters.

9. A method according to claim 6, 7 or 8 wherein said microscopic image comprises one or more words.

10. A method according to one or more of claims 6 to 9 whereby each of said alphanumeric characters occupies an area of less than .2 millimetres square and the density of said alphanumeric characters is in the range of 1-3 character lines per millimetre.

Fig. 1

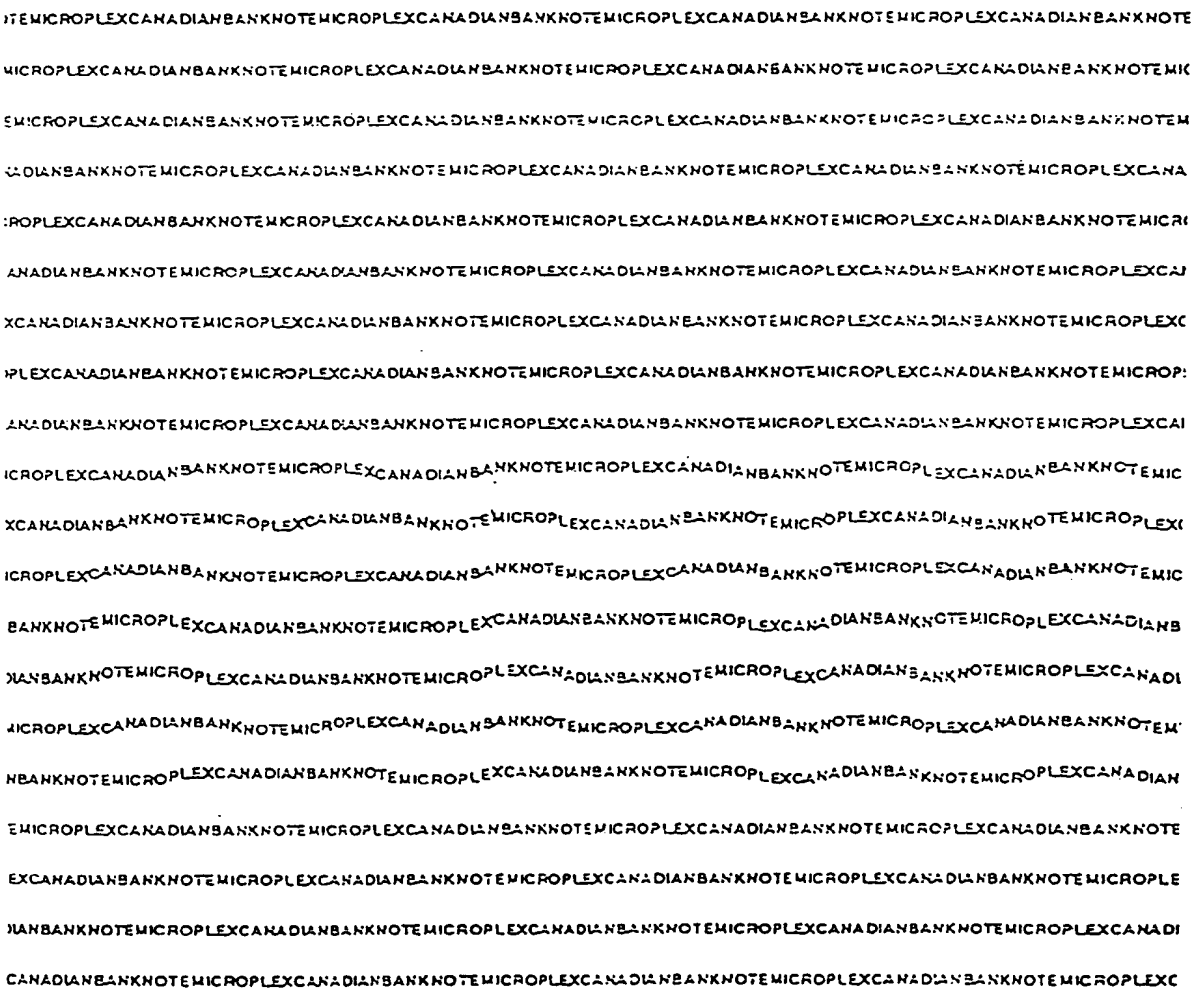

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Fig. 2

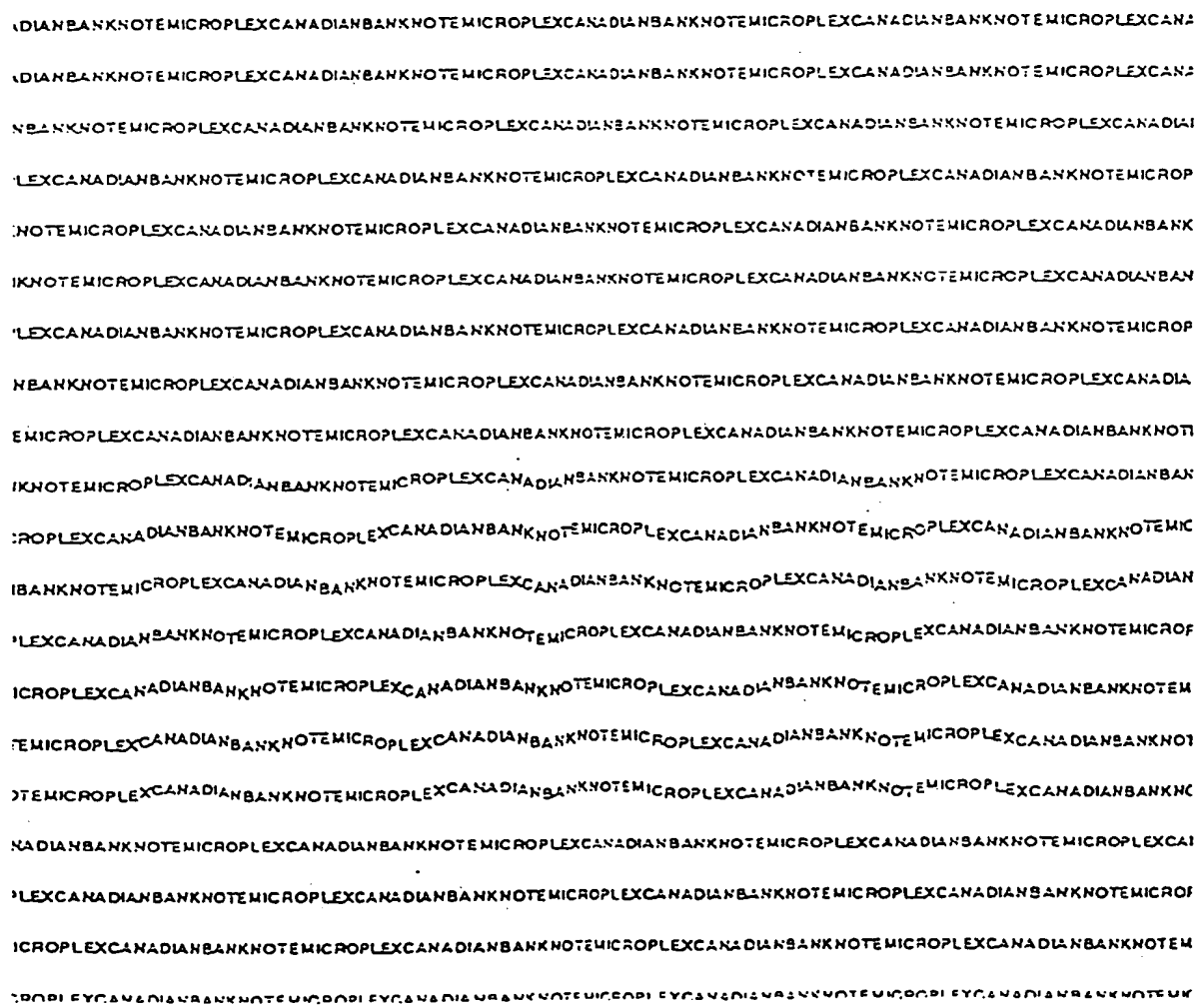
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Fig.3

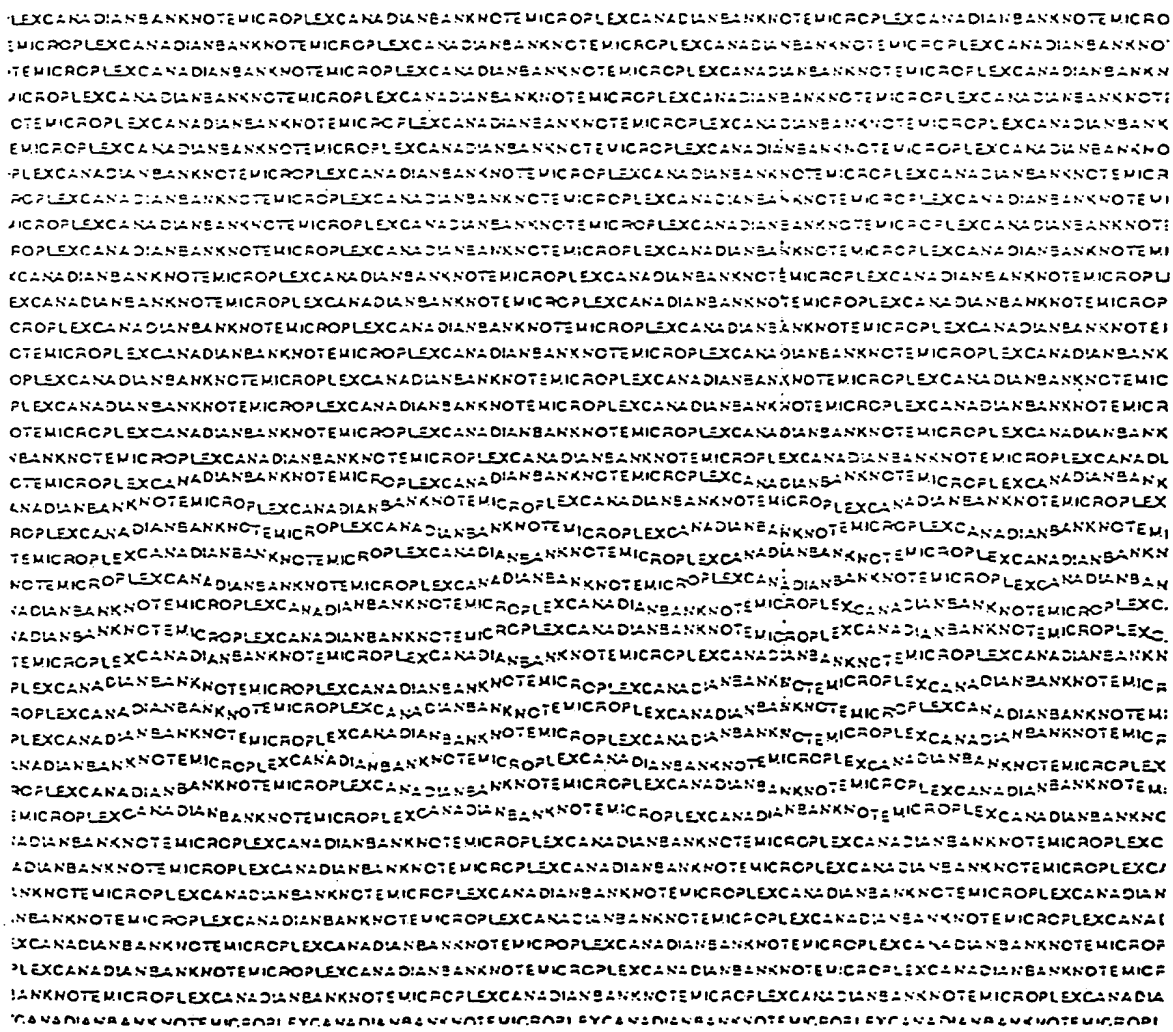

Fig.4

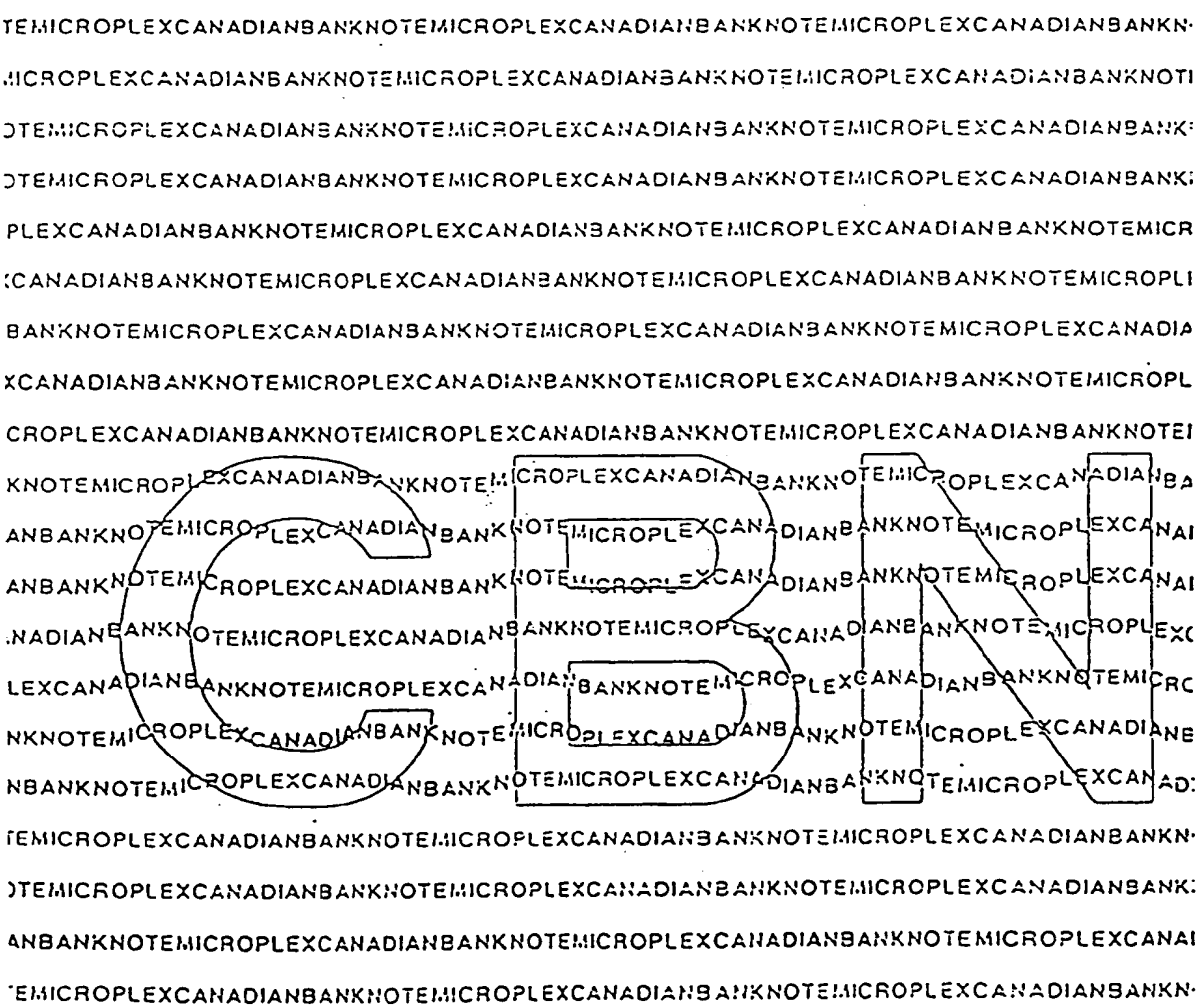
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Fig.5


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Fig. 6

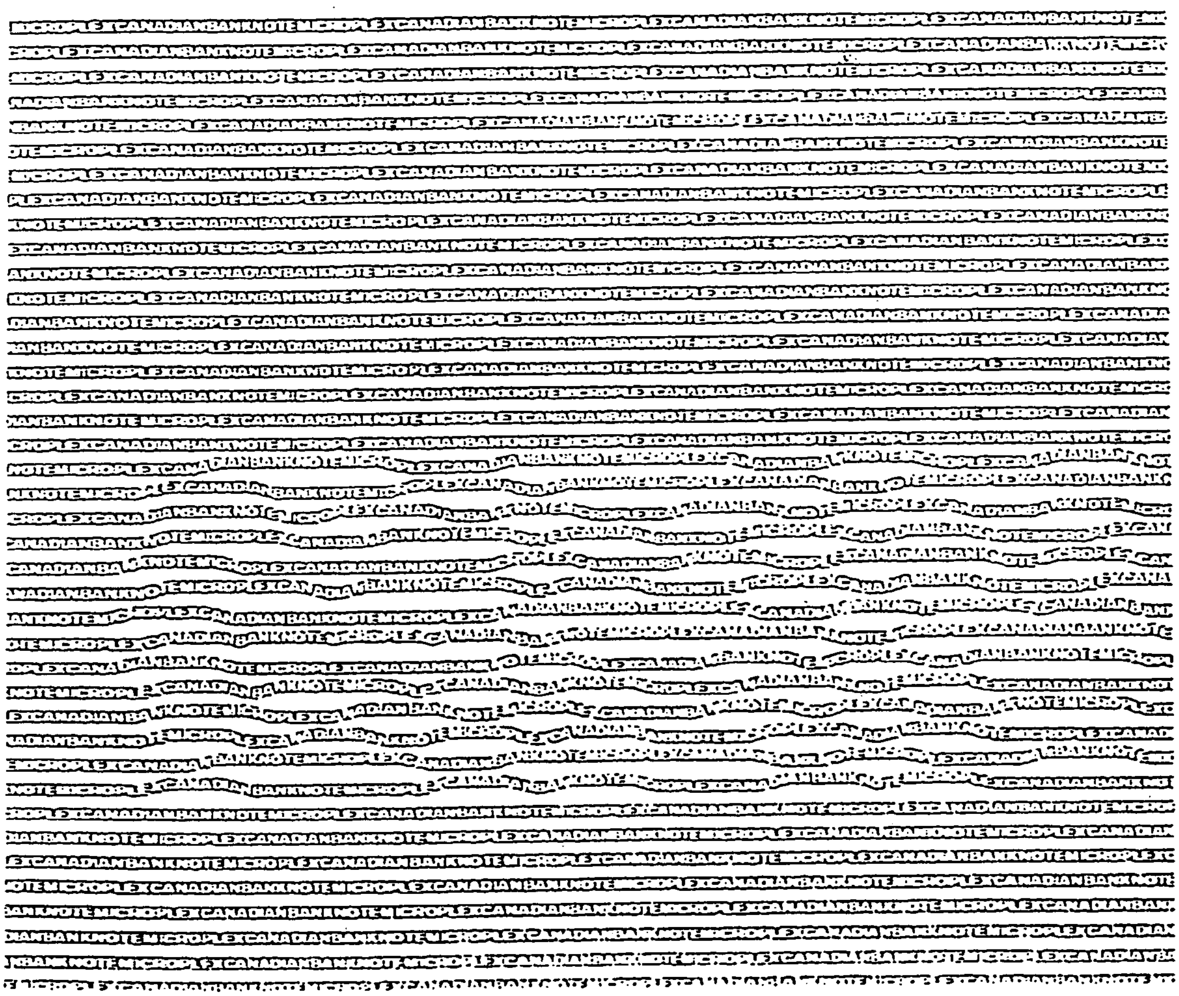


Fig.7

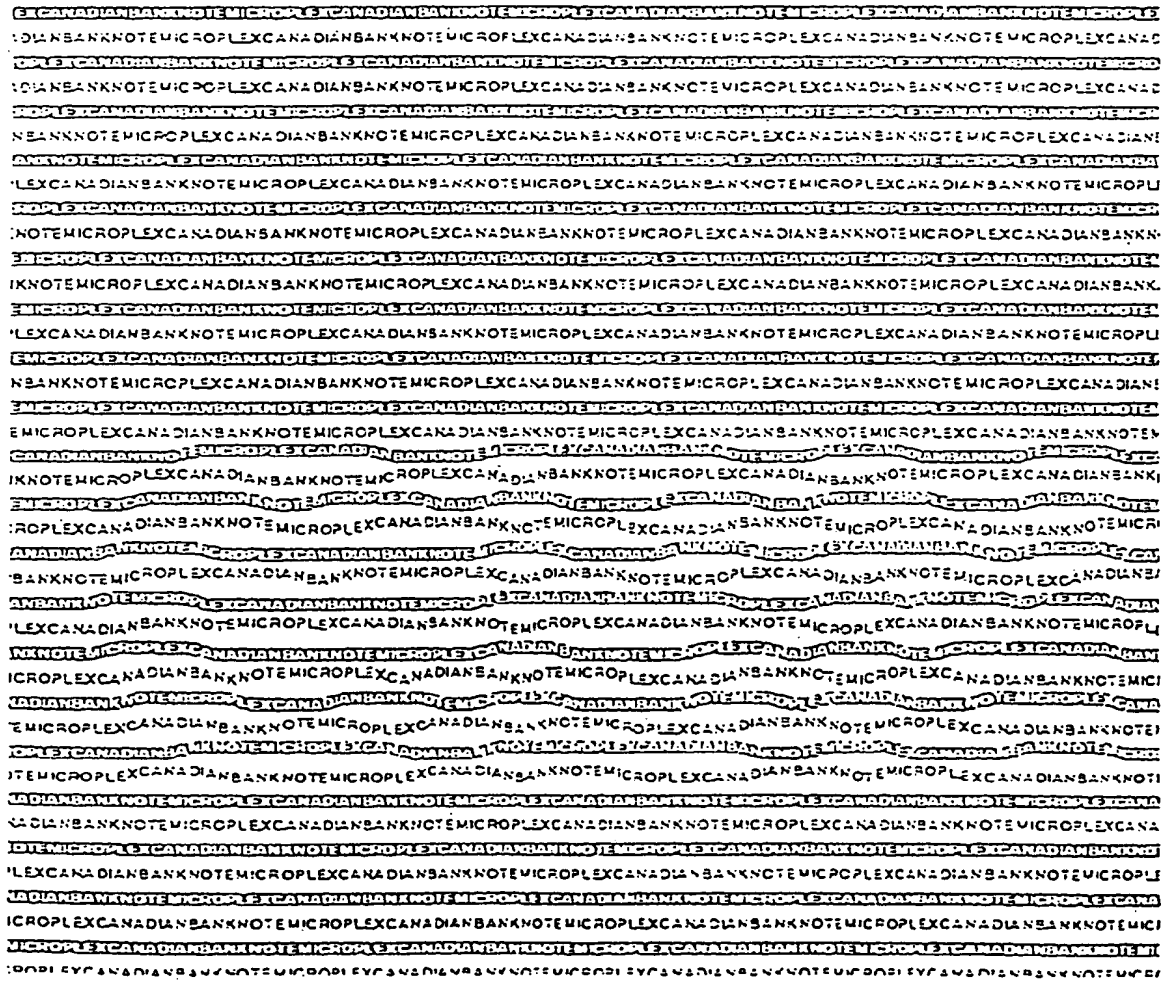
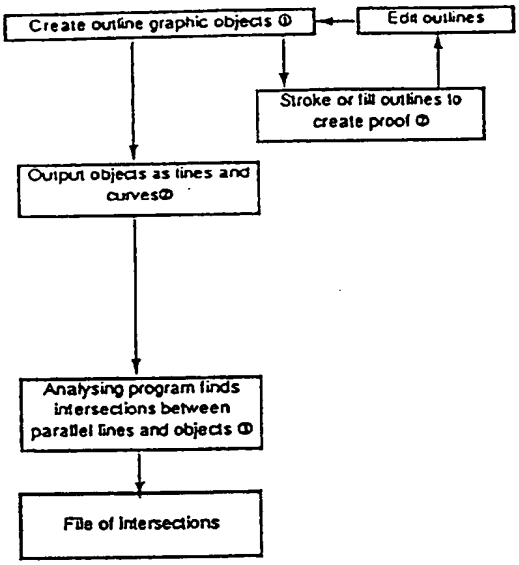


Fig. 8

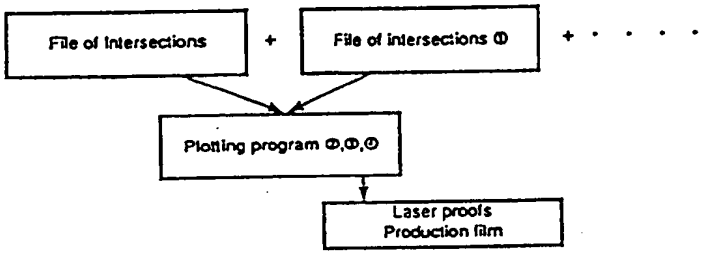
Schematic Representation of Computer Generation Process

A.



Notes:
1. This can be an outline font or any graphic objects created with a drawing program or explicity programmed.
2. Use of PostScript language and interpreters can simplify these steps.
3. Options to the analysing program include the line spacing and length.

B.



Notes:
1. Multiple files of intersections, each for a different object or set of objects can be combined together.
2. This may conveniently be executed on a PostScript interpreter which allows enlarged proofing on a laser printer and high quality real size film output on a photosetter.
3. The output may be as lines or as text tracking the lines (character lines).
4. Options to the plot program include: the height of the shift, the slope of the run-up and run-down, the character string, font, size, and face (white or black).

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 92 11 0541

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	US-A-4 891 666 (GORDON) * claims; figure 2 *	1-10	B41M3/14 B42D15/00
A	DE-B-1 066 462 (R.OLDENBOURG GMBH) * the entire document *	1-10	
A	CA-A-1 066 109 (CANADIAN BANK NOTE COMPANY LTD.) * claims; figures 4,6 *	1-10	
A,D	CA-A-1 172 282 (CANADIAN BANK NOTE COMPANY LTD.) * claims; figures *	1-10	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B41M
B42D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	02 OCTOBER 1992	HILLEBRECHT D.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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